Genitourinary Ultrasound

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KEYWORDS

• Pocus • Ultrasound • Renal • Bladder • Testicular • Hydronephrosis • Renal colic • Testicular torsion

KEY POINTS

- A point-of-care ultrasound (POCUS)-first approach to suspected renal colic is safe and associated with shorter emergency department length of stay, decreased radiation exposure, and reduced health care system costs.
- POCUS is an easy and convenient tool to measure bladder volume and to diagnose urinary retention.
- Emerging evidence suggests that integration of POCUS into the assessment of acute scrotal pain may help diagnose testicular torsion accurately.

INTRODUCTION

Patients frequently present to the emergency department (ED) with symptoms related to the renal system or the male genitourinary (GU) system. Common presenting symptoms include flank pain, dysuria, hematuria, frequency, urinary retention, or scrotal pain. The most common etiology of acute flank pain is renal colic, with a 10.6% prevalence of urolithiasis in the general population.[1] Male patients often present to the ED with complaints of lower urinary tract symptoms, with a national annual incidence of almost 200 per 100,000 males.[2] Although scrotal complaints are less common, testicular torsion is an important surgical emergency affecting about 6 per 100,000 males annually between the ages of 1 and 17 years.[3]

Ultrasound has become the recommended initial imaging modality for diagnosing renal colic,[4] urinary retention,[5] and testicular pathology.[6] Traditionally, this imaging was performed in the radiology department, but point-of-care ultrasound (POCUS) has emerged to become an effective first line imaging tool for these ED presentations.[7,8]

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DISCUSSION

Renal

Sonographic approach

A low frequency probe is used to examine the renal system while the patient is supine or in the decubitus position. While the curvilinear and phased array probes can be used, the curvilinear probe has a larger footprint allowing for better visualization and measurement of the kidneys. The probe is placed in a longitudinal orientation at the mid-to-posterior axillary line at the level of the xiphoid. The right kidney is more sonographically accessible as the liver is an excellent acoustic window. The left kidney is more challenging to visualize due to the spleen providing a smaller acoustic window, and may require a more posterior scanning approach. Rotation of the probe 90° counterclockwise from the long axis plane will generate a short axis view.

In the long axis, the kidney is shaped like a bean with the inferior pole of each kidney located anterior and lateral in relation to the superior pole (**Fig. 1**). The renal cortex has a homogeneous echogenic appearance on ultrasound. The renal medulla is slightly less echogenic than the surrounding cortex. The renal sinus is composed of the pelvicalyceal system, fat, and renal vessels, and appears hyperechoic relative to the parenchyma. The urinary collecting system in the renal sinus should not be visible in a normal kidney. A normal kidney measures 4 to 5 cm in width and 9 to 12 cm in length.[9]

There are anatomic variants in the normal appearance of the kidney. The left kidney can be molded by the adjacent spleen to take on the appearance of a 1-hump dromedary camel, termed the 'dromedary hump' (**Fig. 2**).[10] Patients may have abnormal variation in the formation of their kidneys, like the horseshoe kidney resulting from a congenital fusion abnormality of the urinary tract.[11]

Pathology

Hydronephrosis. Hydronephrosis refers to the dilation of the renal pelvis and calyces. As the renal pelvis fills with fluid, it becomes progressively anechoic. Hydronephrosis can be graded as mild, moderate, or severe. Mild hydronephrosis is dilation of the major calyces or renal pelvis with preservation of the renal papillae (**Fig. 3**A). Moderate hydronephrosis is present when major and minor calyces are dilated with obliteration of the renal papillae and blunting of the renal pyramids (**Fig. 3**B). Severe hydronephrosis is defined as calyceal ballooning with cortical thinning (**Fig. 3**C).[12] Several conditions can mimic hydronephrosis. Prominent renal hilar vessels can be mistaken for a dilated collecting system, but color Doppler can easily distinguish this from

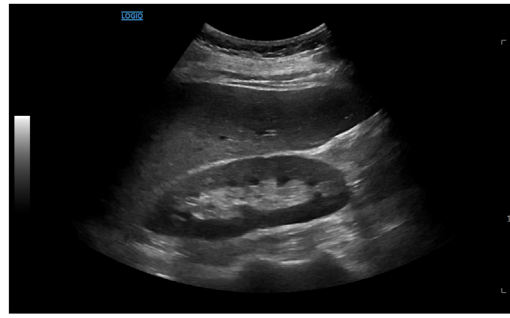

Fig. 1. Normal sonographic appearance of a kidney. The renal parenchyma appears less echogenic than the hyperechoic renal sinus.

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Fig. 2. Left kidney demonstrating a dromedary hump, where the mid-aspect of the kidney has the appearance of a one-hump dromedary camel.

hydronephrosis (Fig. 4).[13] Parapelvic cysts can also be misinterpreted as hydronephrosis. These are renal cysts located around the renal pelvis or sinus, and can be differentiated by their spherical shape and lack of communication with the collecting system.[13]

When compared to computed tomography (CT) as the reference standard, emergency physicians (EPs) have a sensitivity of 81% (95% confidence interval CI 80%–83%) and specificity of 59% (95% CI 56%–63%) for detecting hydronephrosis. Their specificity improved to 95% (95% CI 94%–95%) for identifying moderate or severe hydronephrosis, compared to none or mild.[14]

Nephrolithiasis. Sonographically, stones are hyperechoic with posterior shadowing (Fig. 5). Stones within the kidney are often visible, but ureteric stones are poorly visualized due to bowel gas and lack of a sonographic window. Ureteric stones near the ureterovesical junction can sometimes be visualized when scanning through the bladder.[9,12] Color Doppler may demonstrate the twinkling artifact, a rapidly changing mixture of red and blue behind a strong reflector, like urinary stones (Fig. 6). The twinkling artifact is 86% sensitive (95% CI 72%–94%) and 92% specific (95% CI 75%–98%) for urolithiasis.[15]

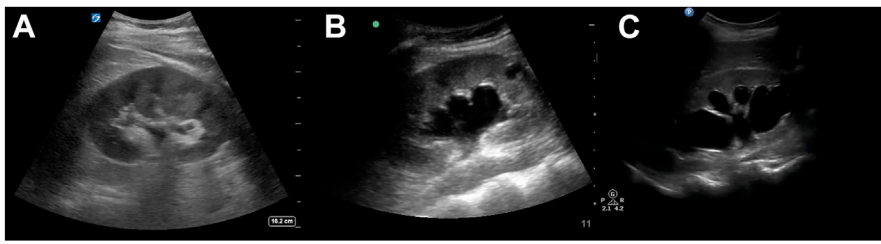

Fig. 3. (*A*) Mild hydronephrosis appears as dilation of the major calyces or renal pelvis with preservation of the renal papillae. (*B*) Moderate hydronephrosis appears as dilation of the major and minor calyces with obliteration of the renal papillae and blunting of the renal pyramids. (*C*) Severe hydronephrosis appears as calyceal ballooning with cortical thinning.

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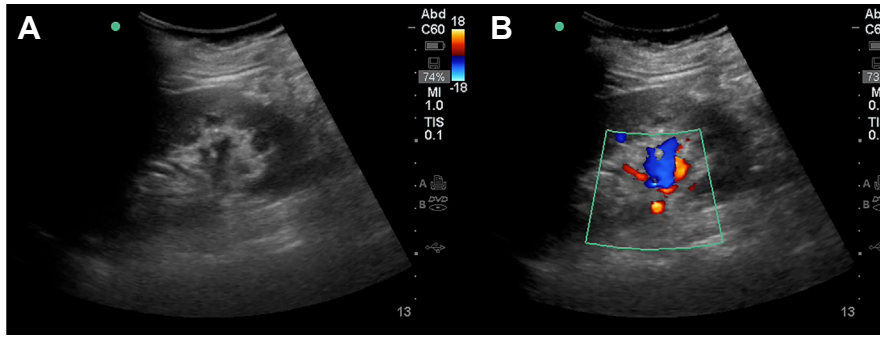

Fig. 4. Prominent renal hilar vessels (*A*) can be mistaken for a dilated collecting system, but the presence of flow on color Doppler (*B*) easily differentiates prominent renal hilar vessels from hydronephrosis.

POCUS is only 45% sensitive for directly visualizing renal or ureteric stones, and it is less accurate for detecting smaller stones less than 3 mm.[16] Although a stone may not be directly visualized, the presence of hydronephrosis on POCUS, in the correct clinical setting, is supportive of a diagnosis of renal colic. A systematic review and meta-analysis found that POCUS, when any degree of hydronephrosis was considered a positive finding, was 70% sensitive (95% CI 67%–73%) and 75% specific (95% CI 73%–78%) for nephrolithiasis.[17] The degree of hydronephrosis on POCUS correlates with the size of the stone. Patients with absent or mild hydronephrosis are more likely to have stones less than or equal to 5 mm.[18] Absent or mild hydronephrosis predicts a high likelihood of spontaneous stone passage, whereas severe hydronephrosis has up to a 43% stone passage failure rate.[19] An additional consideration is that up to 11% of patients passing ureteric stones will not have hydronephrosis on imaging.[20] Despite these limitations, a landmark comparative effectiveness trial from 2014 randomized 2759 patients with suspected nephrolithiasis to 1 of 3 initial imaging arms: CT, radiology-performed ultrasound, or EP-performed POCUS. There was no difference in the primary outcome of high-risk diagnoses with complications during the first 30 days between study groups, and the POCUS group had shorter ED length of stay and decreased radiation exposure.[7]

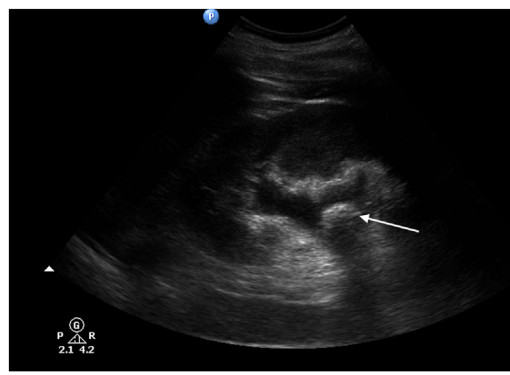

Fig. 5. Ultrasound image of a ureteropelvic junction stone (*arrow*) with concomitant hydronephrosis. Renal stones have a hyperechoic appearance with posterior shadowing. (Image credit: Robert Jones, DO FACEP, FAIUM.)

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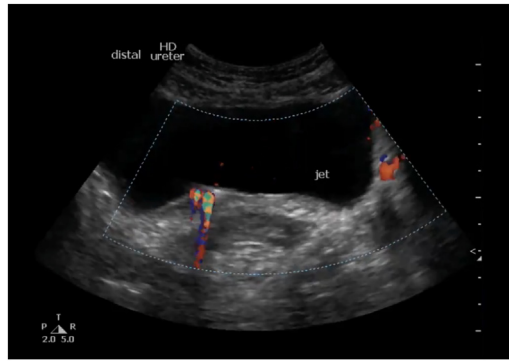

Fig. 6. The twinkling artifact, a rapidly changing mixture of red and blue on color Doppler behind a strong reflector, like a urinary stone. (Image credit: Robert Jones, DO FACEP, FAIUM.)

In a patient presenting with suspected renal colic, the patient should be screened for high risk features, including age greater than 50 without nephrolithiasis history, fever, hemodynamic instability, acute kidney injury, solitary kidney, transplanted kidney, or intractable symptoms.[21] If the patient does not have high risk features, symptoms should be treated and a POCUS-first approach should be used. Mild-to-moderate hydronephrosis confirms the diagnosis of renal colic, and if symptoms resolve, the patient can be discharged, while severe hydronephrosis should be further assessed with CT.[18,19] Clinicians should exercise clinical judgment and consider further investigations, especially if the patient has intractable symptoms or there is diagnostic uncertainty (**Fig. 7**).

Pyelonephritis. Acute pyelonephritis is an infection of the renal pelvis and parenchyma. It is generally diagnosed clinically without imaging.[22] In uncomplicated pyelonephritis, the kidneys generally appear normal on ultrasound.[23] The patient may have maximal tenderness on 'sonopalpation' with the probe directly over the kidney.[24] More advanced cases of pyelonephritis can appear as an enlarged, edematous kidney with a hypoechoic appearance of the renal parenchyma.[23] Additional potential sonographic findings include loss of corticomedullary differentiation and urothelial thickening (**Fig. 8**).[23]

Severe inflammation of the renal parenchyma can cause multiple small suppurative foci that may ultimately coalesce into a larger renal abscess. Renal abscess appears as an echogenic or anechoic mass with well-defined borders.[23] Pyonephrosis, or infected hydronephrosis, is represented by echogenic material within the dilated pelvicalyceal system. It represents pus under pressure and requires urgent decompression.[23] If gas-forming organisms infect the renal parenchyma, the patient has emphysematous pyelonephritis, which usually occurs in immunocompromised or diabetic patients. On POCUS, there are highly echogenic areas within the renal parenchyma or perirenal tissues associated with dirty posterior shadowing (**Fig. 9**).[23] Identification of one of these complications on POCUS warrants further imaging with CT and urology consultation.

Cysts. Renal cysts are the most common structural lesion of the kidney. Renal cysts are categorized according to the Bosniak classification system, which has 5 categories based on the imaging features of the cyst. Simple renal cysts are internally anechoic, appear round or ovoid in shape, and have sharply demarcated, thin smooth walls (**Fig. 10**). A simple renal cyst is classified as Bosniak category I and does not require any follow-up.[25,26]

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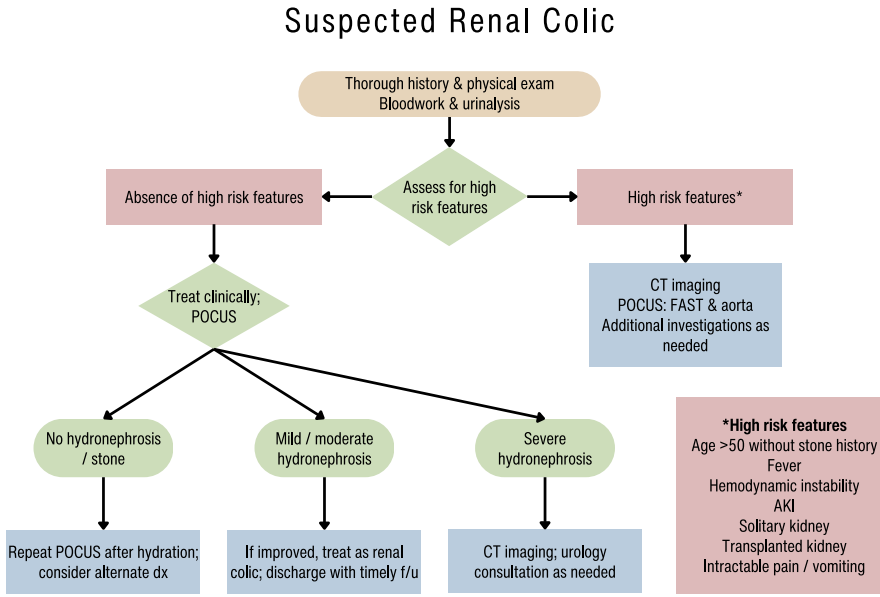

Fig. 7. Clinical algorithm for implementing a point-of-care ultrasound (POCUS)-first approach to suspected renal colic. Dx, diagnosis; CT, computed tomography; F/u, follow-up; FAST, focused assessment with sonography in trauma; AKI, acute kidney injury.

Approximately 5% to 10% of renal cysts are complex, containing septations, calcifications, wall thickening, or nodularity on ultrasound. These make up Bosniak categories II to IV and require further investigation as they are at higher risk of malignancy.[27] Multiple renal cysts can be seen in genetic conditions like polycystic kidney disease and require follow-up as they can be associated with development of chronic kidney disease or transition to malignant disease.[28]

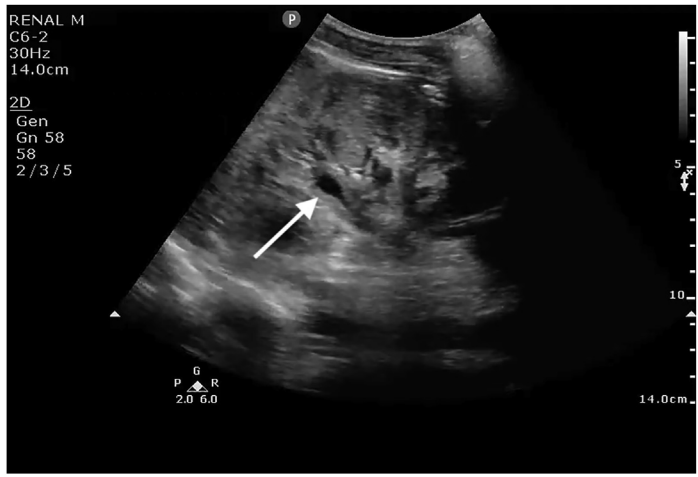

Fig. 8. Ultrasound image of pyelonephritis, with presence of urothelial thickening (*arrow*). (Image credit: Robert Jones, DO FACEP, FAIUM.)

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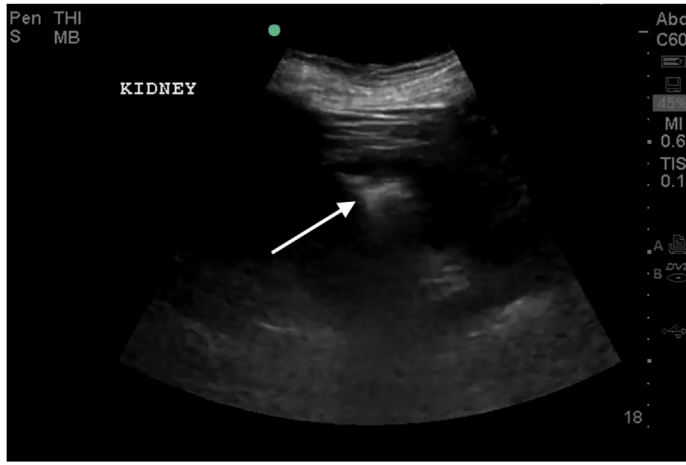

Fig. 9. Ultrasound image of emphysematous pyelonephritis, sonographically represented by highly echogenic areas (*arrow*) within the renal parenchyma associated with dirty posterior shadowing. (Image credit: Robert Jones, DO FACEP, FAIUM.)

Trauma. Visualization of the kidneys is part of the focused assessment with sonography in trauma (FAST). However, the FAST examination is used to assess for the presence or absence of intraperitoneal free fluid, rather than identification of solid organ injury.[29] POCUS is only 22% to 67% sensitive for making this diagnosis. However, sonographic identification of renal injury is highly specific, in the range of 96% to 100%.[29] Injuries to the renal parenchyma appear as hyperechoic or hypoechoic areas with distortion of the normal renal echotexture. Renal hematomas are acutely heterogeneous and echogenic, and with time they become more hypoechoic relative to the surrounding tissue (**Fig. 11**). Subcapsular hematomas are heterogeneous round or elliptical collections that contour the kidney and may flatten its rounded edges due to preservation of the renal capsule. Renal lacerations are tears through the renal parenchyma that usually have a hypoechoic linear appearance, perpendicular to the organ surface.[30] If the clinician has ongoing concerns about renal injury, the patient should undergo definitive CT imaging.[29]

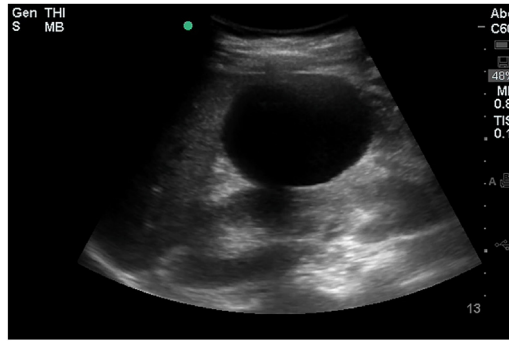

Fig. 10. Simple renal cyst that is round, has thin smooth walls, and is internally anechoic.

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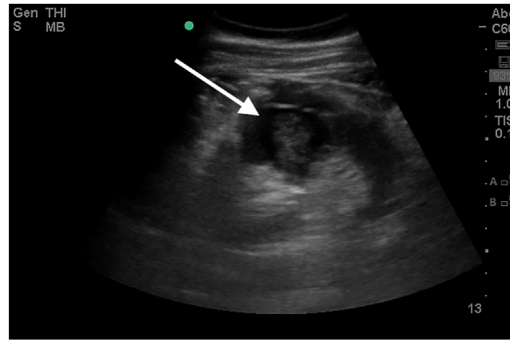

Fig. 11. Ultrasound image of a renal hematoma, appearing as a heterogeneous and echogenic area (*arrow*) in the parenchyma of the kidney distorting its normal renal echotexture.

Bladder

Sonographic approach

The bladder can be assessed using a curvilinear probe with the patient in a supine position. The probe is placed just above the pubic symphysis, angled down toward the pelvis, with the probe marker oriented toward the patient's head in the sagittal plane and toward the patient's right in the transverse plane. It is best practice to capture images in both planes to visualize the entire bladder, including the lumen and its walls (**Fig. 12**).[31]

Rarely, the sonographer may visualize an outpouching from the bladder; this is known as a bladder diverticulum (**Fig. 13**). It represents herniation of the bladder mucosa through a point of weakness in the detrusor muscle and can occur either congenitally or as a result of bladder outlet obstruction, neurogenic bladder, or prior bladder surgery.[32] They are asymptomatic but can be associated with malignancy.[32]

Bladder Volume. Using POCUS to measure bladder volume is convenient, easy, and safe, particularly when compared to traditional urinary catheterization. It is particularly

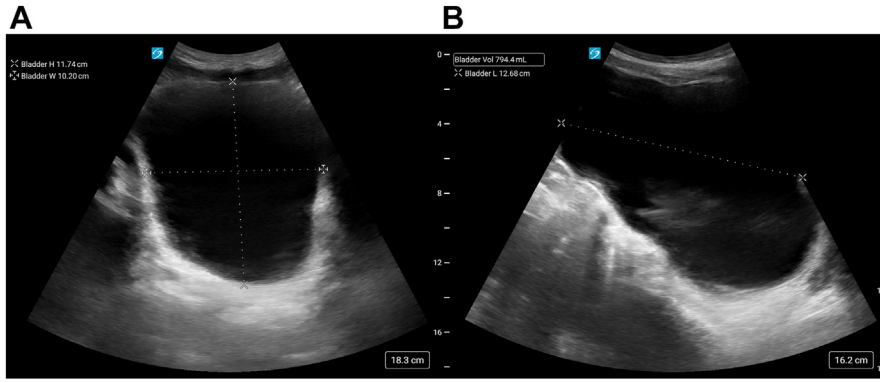

Fig. 12. Ultrasound image of an anechoic filled urinary bladder, imaged in both transverse (*A*) and sagittal (*B*) planes. Calipers have identified the maximal width and antero-posterior diameter in the transverse plane (*A*), as well as the maximal length in the sagittal plane (*B*).

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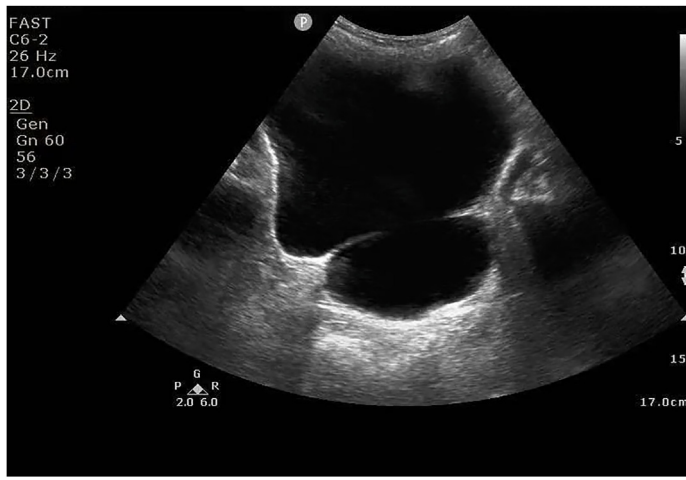

Fig. 13. Ultrasound image of a bladder diverticulum, the outpouching from the main bladder in the far field. (Image credit: Hashim Kareemi, MD.)

useful in the setting of potential bladder outlet obstruction, as structured questionnaires based on symptoms are unreliable.[5] Measuring the bladder volume also has utility in pediatrics for acquiring urine from very young children. Sterile urinary catheterization is the best way to acquire a urine sample, but may cause unnecessary discomfort if the bladder is empty. POCUS can increase the success rate of urine acquisition; a transverse bladder diameter of greater than or equal to 2 cm is correlated with an adequately filled bladder in pediatrics.[33]

To measure the bladder volume, begin by obtaining a transverse view of the bladder. Measure the maximal width and antero-posterior diameter of the bladder. Next, obtain a sagittal view of the bladder and measure its maximal length (see **Fig. 12**). The bladder volume can then be estimated by using the formula: bladder volume = 0.7 x length x width x antero-posterior diameter.[34] Most ultrasound machines include this as part of a standard calculation package.

Ureteric Jets. Ureteric jets represent the normal and intermittent efflux of urine into the bladder. On POCUS, they appear as bursts of echoes entering the bladder from the ureteric orifices in the region of the trigone, the base of the urinary bladder. Ureteric jets can sometimes be visualized on standard B mode imaging, but they are more readily seen with color Doppler (**Fig. 14**).[35,36] The absence of ureteric jets is associated with physiologic ureteric obstruction, but accurate evaluation requires observation up to 10 minutes in duration. There is some question about the clinical utility of assessing ureteric jets.[35] In the setting of renal colic, the presence of ureteric jets is associated with spontaneous stone passage, and the absence of ureteric jets is correlated with a low likelihood of stone passage.[36]

Foley Placement. While urinary catheterization is a common procedure performed in the ED, the use of foley catheters can be associated with complications including urethral injury, potential urethral stricture, creation of false tracts, incorrect placement, or obstruction of the catheter.[37] Since the balloon of the foley catheter is filled with water, it will have an anechoic spherical appearance on ultrasound when inflated. With a properly functioning foley catheter, the bladder will be decompressed with the balloon of the catheter present in the bladder (**Fig. 15**A). If the catheter is malfunctioning or is

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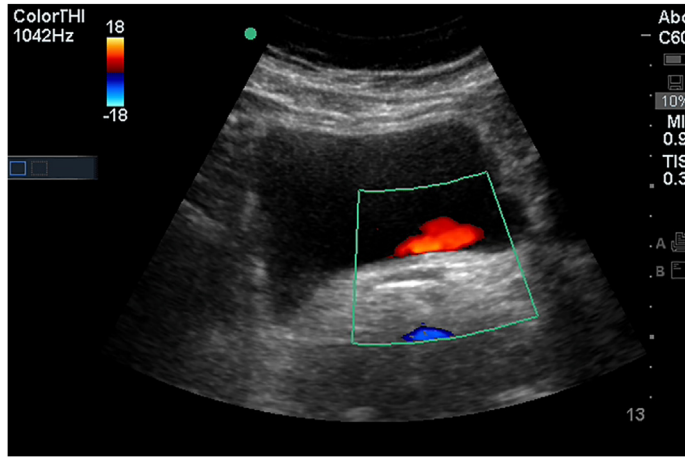

Fig. 14. Ureteric jet on color Doppler appearing as a burst of echos entering the bladder from the ureteric orifice in the base of the bladder.

clamped, the bladder will be distended with a readily visible balloon within the bladder (**Fig. 15**B).[38]

Testicular

Sonographic approach

The patient is positioned in a supine or semi-recumbent position with a towel to elevate the scrotum and stabilize the contents within. Each hemi-scrotum is sequentially imaged using a linear probe in both the sagittal and transverse planes. The asymptomatic side should be scanned before the symptomatic side. All structures within each hemi-scrotum should be imaged with both B-mode and Doppler.[31] Doppler settings should be optimized on the asymptomatic side to provide a comparative baseline. Care must be taken to ensure the probe and scrotal contents are fixed when acquiring Doppler images as motion can be mistaken for flow. Spectral Doppler of a normal testicle should demonstrate high flow, low resistance waveforms.[39,40]

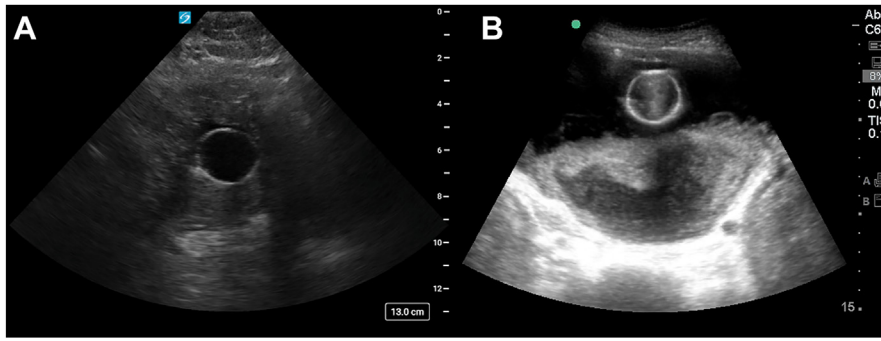

Fig. 15. Ultrasound image of a properly functioning foley catheter (*A*) with a decompressed bladder surrounding the balloon of the catheter. This is in contrast to a malfunctioning foley catheter (*B*) with a readily visible balloon present in a partially distended bladder. Echogenic debris in the far field represents blood and clots.

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Normal testicular parenchyma is sonographically homogenous (Fig. 16). The mediastinum testis may be visible within as a horizontally-oriented echogenic band. The epididymis consists of a head, body, and tail that are isoechoic or hypoechoic compared to the testicular parenchyma. The epididymis continues superiorly as the vas deferens in the spermatic cord along with the cremasteric artery, testicular artery, and pampiniform plexus.[41]

Pathology

Testicular torsion. Testicular torsion is a surgical emergency with viability of the testis correspondingly related to the time of ischemia.[42] Testicular blood flow is compromised as the spermatic cord rotates through 180°, and may rotate up to 720°.[39] Testicular torsion is more common in younger patients presenting with rapid onset, acute severe pain. The testis is typically tender, edematous, asymmetric, and may be high riding.[6,40] Risk stratification for testicular torsion can be performed using clinical gestalt or using a structured tool like the Testicular Workup for Ischemia and Suspected Torsion score (Table 1).[43]

The underlying etiology of acute scrotal pain is difficult to determine based solely on history and physical examination, so timely ultrasound imaging of the acute scrotum is essential.[6,40] On B mode imaging, an acutely torsed testicle may initially appear unremarkable. As the ischemic period continues, venous congestion persists and edema develops.[40] The testicle may become enlarged and progressively appear more hypoechoic with later development of heterogeneous echotexture within the affected testis (Fig. 17).[39,40] A reactive hydrocele may be present. The spermatic cord should also be imaged, as it may demonstrate a whirlpool sign, a twisting of the spermatic cord into a spiral-like pattern (Fig. 18).[39]

A "buddy shot" view with both testes in the same view can be helpful for providing direct comparison of overall testicular vascularity on color Doppler (Fig. 19). A lack of blood flow on color Doppler within the affected testicle is diagnostic of ischemia.[39] The epididymis is also commonly avascular as it receives its blood supply from the testicular artery, but the presence of epididymal or testicular flow on color Doppler does not exclude testicular torsion as cases of partial or intermittent torsion can still present with flow. Spectral Doppler may be helpful in these cases to detect a waveform that is abnormal.[39] It is imperative to employ clinical judgment in these situations and obtain consultative imaging when required.[6]

Testicular appendages are relatively common and typically are found near the head of the epididymis. They may arise from either the epididymis or testicle and may be solid or cystic in nature. The classic physical examination finding of testicular appendage torsion is the 'blue dot', though this may occur in only a minority of

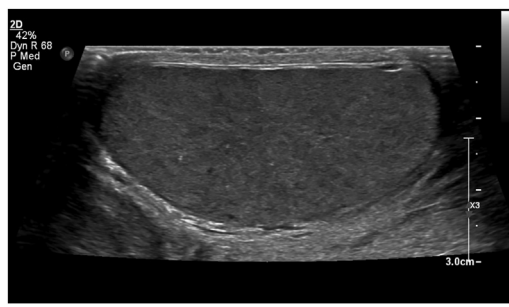

Fig. 16. Sonographically homogenous echotexture of a normal testicle.

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Table 1
Testicular Workup for Ischemia and Suspected Torsion (TWIST) score for clinical risk stratification of acute nontraumatic scrotal pain. Low risk score = 0-2 points. Intermediate risk score = 3-4 points. High risk score = 5-7 points

TWIST Score Component	Points
Testicular swelling	2
Hard testis	2
Absent cremasteric reflex	1
Nausea or vomiting	1
High riding testis	1

patients. When torsed, the appendage has an absence of internal vascularity but increased periappendiceal flow.[44] It will commonly enlarge due to engorgement and inflammation, and a reactive hydrocele may develop (**Fig. 20**).[44]

A systematic review and meta-analysis found radiology-performed ultrasound had a sensitivity of 86% (95% CI 79%–91%) and specificity of 95% (95% CI 92%–97%) for testicular torsion.[45] A systematic review and meta-analysis of 4 studies with 784 patients suggests that POCUS can accurately diagnose testicular torsion with a sensitivity of 98% (95% CI 89%–100%) and specificity of 97% (95% CI 87%–99%).[8] However, these studies did not employ spectral Doppler, the majority of patients were scanned by urologists after selection for emergent surgical exploration, only 1 study had scans performed by pediatric EPs, and none of the studies provided a detailed description of sonographer training. It is therefore unclear how generalizable this diagnostic accuracy is.[8]

Fig. 17. Ultrasound image of testicular torsion with prolonged ischemia appearing as an enlarged testicle with edema and abnormal heterogeneous echotexture. (Image credit: Resa E Lewiss, MD.)

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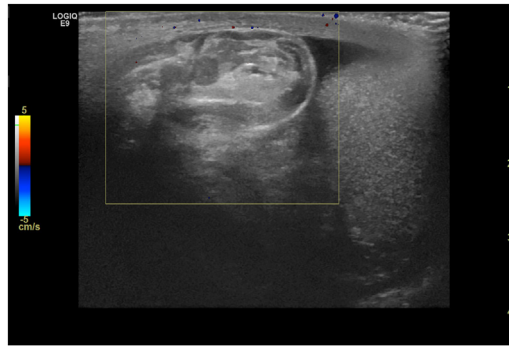

Fig. 18. The whirlpool sign, twisting of the spermatic cord into a spiral-like pattern.

In a high risk patient, findings consistent with testicular torsion or an absence of Doppler flow mandates emergent urologic consultation. If the clinical suspicion is high enough, the patient should still undergo urgent radiology department ultrasound or urologic consultation (Fig. 21).[6]

Epididymitis & orchitis. Epididymitis and orchitis result from retrograde bacterial travel from the lower urinary tract. Sonographically, the epididymis typically appears enlarged, heterogenous, and hypoechoic relative to the testicle (Fig. 22). On color Doppler, the epididymis is hyperemic. If the testicle is involved, it may appear enlarged, heterogenous, and hypervascular as a result of vasodilation and edema (Fig. 23). The presence of an intratesticular fluid collection without internal vascularity suggests a testicular abscess.[41]

Hydrocele. A hydrocele is a fluid collection within the tunica vaginalis, typically resulting from an imbalance in scrotal inflow versus lymphatic outflow. It is the most common cause of painless scrotal swelling. Hydroceles appear sonographically as anechoic fluid collections surrounding the testicle (Fig. 24). Weak internal

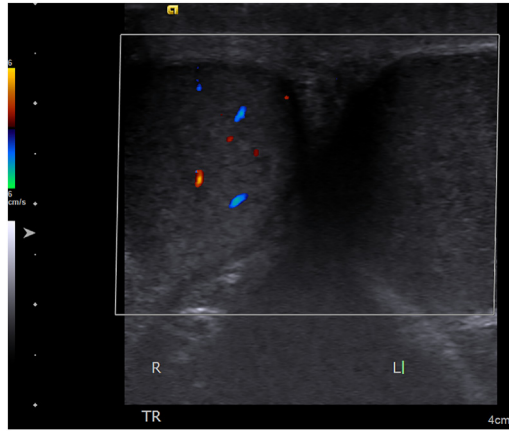

Fig. 19. A "buddy shot" of portions of both testes in the same view allows for direct comparison of overall testicular vascularity on color Doppler. There is color flow in the right testicle, and an absence of color flow in the left testicle, consistent with testicular torsion.

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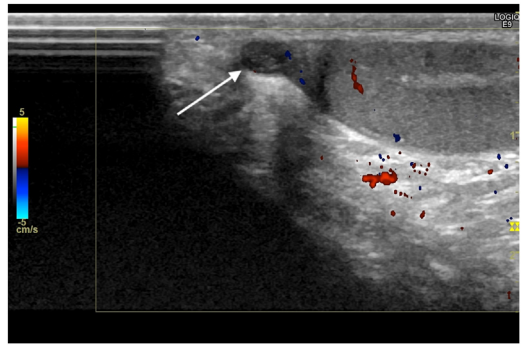

Fig. 20. Ultrasound image of torsion of the appendix epididymis. The appendage (*arrow*) appears as a well circumscribed hypoechoic lesion protruding from the epididymis with an absence of internal vascularity. (Image credit: Jonathan Cohen.)

echoes may be normal, which relate to fibrin or cholesterol content, but the presence of more prominent echoes and septations likely represents more complex fluid collections like hematocele or pyocele.[46] In the setting of acute pain, hydroceles result from intrascrotal causes that may or may not be related to the testicle. These should prompt an urgent search for the underlying cause, like infection, torsion, or trauma.[41]

Varicocele. A varicocele is a dilation of the veins within the pampiniform plexus due to impaired drainage of blood from the spermatic cord and is usually identified when

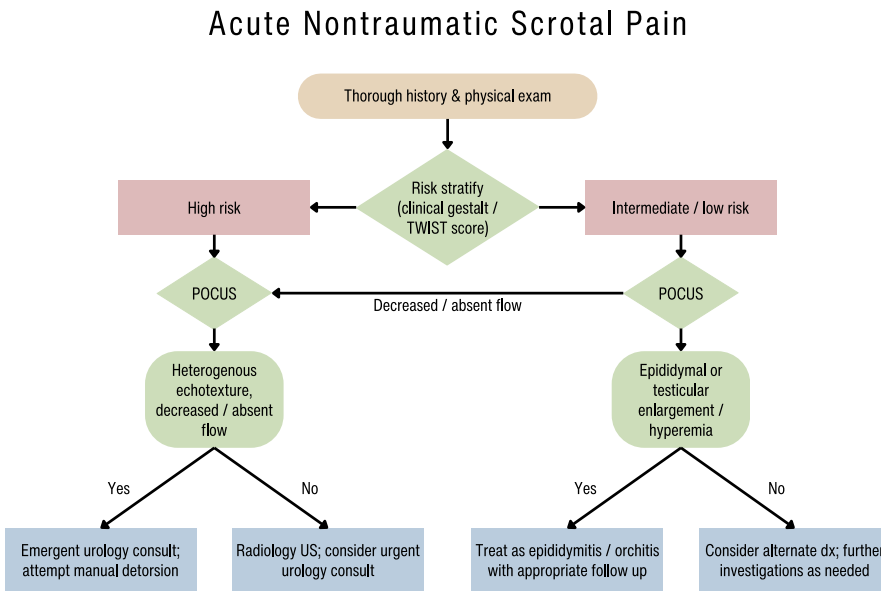
Acute Nontraumatic Scrotal Pain
Thorough history & physical exam
Risk stratify (clinical gestalt / TWIST score)
High risk
Intermediate / low risk
POCUS
Decreased / absent flow
POCUS
Heterogenous echotexture, decreased / absent flow
Epididymal or testicular enlargement / hyperemia
Yes
No
Yes
No
Emergent urology consult; attempt manual detorsion
Radiology US; consider urgent urology consult
Treat as epididymitis / orchitis with appropriate follow up
Consider alternate dx; further investigations as needed

Fig. 21. Clinical algorithm for integrating point-of-care ultrasound (POCUS) into the workup of acute nontraumatic scrotal pain. TWIST score = Testicular Workup for Ischemia and Suspected Torsion score. US, ultrasound; Dx, diagnosis.

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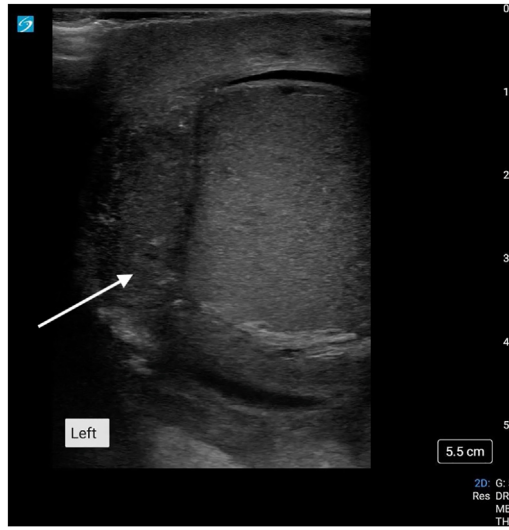

Fig. 22. Ultrasound image of epididymitis with the epididymis (*arrow*) appearing enlarged and heterogeneous.

imaging is performed for other indications.[46] It is extremely common, affecting up to 15% of male patients.[47] There is a larger prevalence of varicocele on the left side given the drainage of the left internal spermatic vein via a longer course into the left renal vein. They can also commonly be found bilaterally. While many varicoceles are benign, an isolated right-sided varicocele is rare and should initiate a workup for intra-abdominal or retroperitoneal pathology.[46]

Sonographically, they appear as multiple hypoechoic or anechoic tubular structures greater than 2 mm in diameter (**Fig. 25**). A Valsalva maneuver should generate retrograde flow on Doppler, and given their compliance, their size should increase.[46]

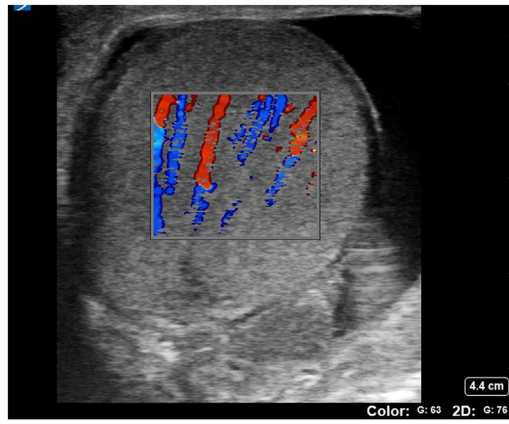

Fig. 23. Ultrasound image of orchitis with hyperemia of the testicle on color Doppler. A simple hydrocele is present on the right side of the image. (Image credit: Dr. Brandon Ritcey, MD, FRCPC.)

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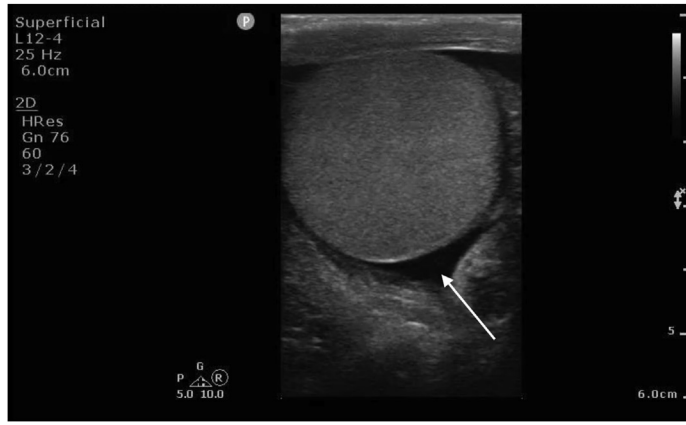

Fig. 24. Ultrasound image of a small simple hydrocele (*arrow*). (Image credit: Dr. Rajiv Thavanathan, MD, FRCPC.)

Trauma. Scrotal trauma occurs most commonly due to blunt injury (80%–85%).[48] Hematoceles are a common finding after blunt trauma. Acutely, they will appear echogenic on ultrasound but will become more hypoechoic, complex, and septated with time.[41] Intratesticular hematoma is another common finding in blunt trauma. Acutely they may have similar echotexture to the surrounding testicle, but with time, they evolve to become more hypoechoic to anechoic.[41] Testicular rupture is a breach of the tunica albuginea, so disruption of the continuity of this line on ultrasound suggests testicular rupture. There is parenchymal damage to the testicle itself, which manifests as distortion of the normal shape of the testicle or heterogeneous echotexture of the testicle itself (**Fig. 26**).[41] Testicular fracture is a discontinuity of the usual testicular parenchyma and sonographically appears as a hypoechoic linear area within the testicle that does not have flow. Testicular fracture is not necessarily associated with tunica albuginea rupture.[41]

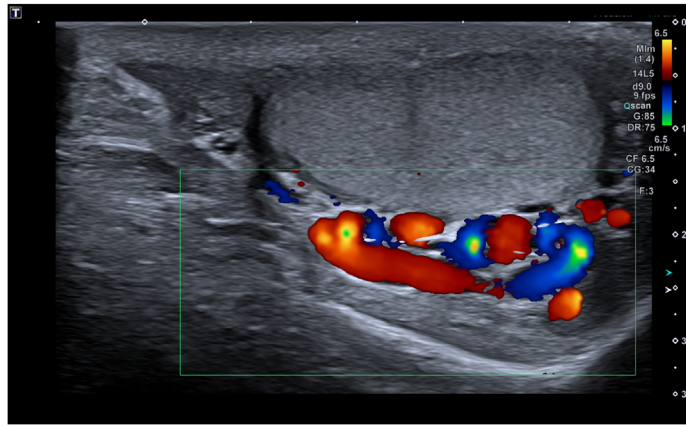

Fig. 25. Ultrasound image of a varicocele, multiple anechoic tubular structures with significant retrograde flow on Valsalva.

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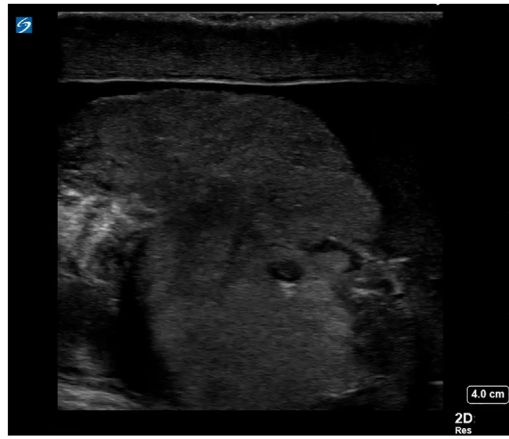

Fig. 26. Ultrasound image of testicular rupture with distortion of the normal shape of the testicle, heterogeneous echotexture of the testicle, and disruption of the tunica albuginea.

SUMMARY

Renal and GU complaints are common reasons for presentation to the ED. These presentations may mimic acutely serious or life-threatening pathology. Physical examination is often imprecise, limiting its utility, so consultative imaging is frequently employed. POCUS can add substantial clinical information with a high degree of accuracy to the evaluation of patients with renal or GU concerns. The relevant anatomy lends itself to POCUS imaging, with typically uncomplicated image interpretation and often immediately actionable clinical integration. Clinicians who employ and integrate renal and GU POCUS have a substantial advantage over those who are reliant on physical examination and consultative imaging.

CLINICS CARE POINTS

- The degree of hydronephrosis can be prognostic in the setting of renal colic.
- POCUS is a useful modality for visualizing stones within the kidney, ureteropelvic junction, and ureterovesical junction, but it does not effectively image ureteric stones and smaller stones less than 3 mm.
- Simple renal cysts are round or ovoid, anechoic, have sharply demarcated thin smooth walls, and do not require any further follow-up.
- When scanning the testicles, ultrasound the asymptomatic side first and optimize Doppler settings; then image the symptomatic side with identical machine settings.
- POCUS findings in testicular torsion include testicular enlargement, edema, heterogeneous echotexture, whirlpool sign, and decreased or absent flow on Doppler.
- In acute nontraumatic scrotal pain, if the clinical suspicion is high enough, the patient should undergo urgent radiology department ultrasound or urologic consultation even if flow is present on POCUS.

DISCLOSURE

D.J. Kim provides consultant services to Fujifilm Sonosite. C.R. Bell has received honoraria from Fujifilm Sonosite. G. Sheppard has nothing to disclose.

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